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Testing Precognition and Alterations of Consciousness with Selected Participants in the Ganzfeld¹

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Abstract. This study is the first to contribute to a registration-based prospective meta-analysis of ganzfeld Extrasensory Perception (ESP) studies. We sought to maximize the anticipated psi effect size by selecting participants for self-reported creativity, prior psi experience or belief, or practice of a mental discipline. We also employed an automated precognition design for simplicity and security, and to add to the small database of precognitive ganzfeld studies. Targets and decoys were short video clips randomly selected with replacement from a pool of 200. As well as predicting overall significant scoring on the ganzfeld precognition task, the study tested the assumption that the ganzfeld method elicits a psi-conducive altered state of consciousness, by correlating two measures of an Altered State of Consciousness (ASC) with precognition task performance. We predicted higher target similarity ratings would be associated with greater evidence of ASC during the session. Three experimenters each conducted 20 trials. Twenty-two direct hits were obtained (37% hit-rate), thus significantly supporting the planned test of the ganzfeld precognition task (exact binomial $p = .03$, 1-tailed). No relation was found between ASC and psi task performance, contrary to prediction. We conclude by discussing the reasons why further ganzfeld ESP research is justified. **Keywords:** Ganzfeld, precognition, meta-analysis, prospective meta-analysis, study registration

Parapsychologists have tested for extra-sensory perception (ESP) using a mild sensory isolation procedure known as the ganzfeld that was pioneered in the mid-1970s by Adrian Parker and Charles Honorton. Honorton's aim was that "the ganzfeld would provide a way of approximating the kinds of 'altered states' that have traditionally been associated with psi, particularly dreaming" (Stanford, 1993, p. 245). Honorton and the skeptical psychologist Ray Hyman published competing meta-analyses of the early ganzfeld ESP database in 1985 (Honorton, 1985; Hyman, 1985). This led to considerable debate over how to interpret the results of these meta-analyses and during the next few years researchers at several laboratories conducted ganzfeld ESP experiments (e.g., Bem & Honorton, 1994).

Milton and Wiseman evaluated 30 studies published between 1987 and February 1997. They con-

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cluded that the combined results from these studies were at chance (27% hit rate, where Mean Chance Expectation - MCE - is 25%) and therefore did not support the existence of ESP (Milton & Wiseman, 1999). Around a decade later, Storm and colleagues picked up from where Milton and Wiseman's work left off, reviewing an additional 30 ganzfeld studies published between March 1997 and 2008 (Storm et al., 2010). Discarding one positive study that was judged to be a statistical outlier, Storm and colleagues found an overall statistically significant result (32% hit rate) and claimed that the data supported the existence of ESP. When all these studies are combined, the overall hit rate is 30%.

Registration-based prospective meta-analysis. Bierman, Spottiswoode, and Bijl (2016) used simulations to argue that the ganzfeld database hit rate is probably inflated by questionable research practices (QRPs), though the database remains statistically significant when QRPs are accounted for. Watt and Kennedy (2017) recommend that many QRPs in the conduct of individual studies (such as data-mining or selective reporting) as well as in the conduct of meta-analysis (such as determining inclusion criteria to include or exclude particular studies after study results are known), can be eliminated by prospectively planning and pre-registering a meta-analysis of pre-registered studies, before any individual studies have been conducted. By using this method, key decisions in the conduct of the meta-analysis are made before individual study results are known, minimizing the possible effects of researcher bias.

At the 2016 Parapsychological Association convention, Watt and Kennedy (2016) promoted the idea of prospective meta-analysis, choosing ganzfeld ESP research as an exemplar because this is a relatively mature line of research. The decision to include a ganzfeld study in the meta-analysis and decisions about qualifications for the evaluation of study data are specified prospectively at the time the study is registered, which eliminates biases (pro or con) from methodological decisions after the study results are known and also allows adaptation to the unique characteristics of a study (unlike a large multi-center collaboration). Watt subsequently posted a prospective meta-analysis of ganzfeld studies on the Koestler Parapsychology Unit (KPU) Study Registry (Watt, 2017a), and the present study is the first to contribute to that endeavor (Watt, 2017b).

Maximizing effect size in the ganzfeld. Although four out of the five ganzfeld meta-analyses mentioned above yielded significant hit rates consistent with the ESP hypothesis, the effect sizes at the individual study level are quite variable (for example ranging from -0.26 to 0.47 in the Storm et al. database). Storm and colleagues reported one variable that could be an important contributor to this heterogeneity: participant type. They found a significantly lower effect size for studies with unselected participants, compared to those whose participants were selected on various criteria including previous experience in ESP experiments, psi belief, psi training, creative/artistic ability, or practice of a mental discipline such as meditation or relaxation [unselected $ES = 0.05$, selected $ES = 0.26$, $t(27) = -3.44$, $p = .002$ (2-t)]. Derakhshani (2014) confirmed that by splitting Storm, Tressoldi, and di Risio's studies into selected (14 studies) and unselected (16 studies) groups, the results for each group became homogeneous. Storm, Tressoldi, and di Risio (2010, p. 480) concluded that "34 years of ganzfeld research has more often than not produced a communications anomaly worth investigating further". However, they cautioned that researchers considering conducting ganzfeld research should note the near zero effect for studies employing unselected participants. Similar conclusions were reached in the review of ganzfeld ESP research by Baptista, Derakhshani, and Tressoldi (2015, p.198), who recommended that the expect-

ed effect size for ganzfeld ESP studies could be boosted through “exclusive use of selected participants.” In other words, if the internal patterns seen in the ganzfeld database are valid, then the use of selected participants should increase statistical power, meaning that fewer trials would be needed to detect a significant effect, compared to a study with unselected participants.

Precognition in the ganzfeld. Most ganzfeld ESP studies have employed either a telepathy or clairvoyance design, though the reason for this may vary from researcher to researcher. Discussing Charles Honorton’s approach, his friend Don McCarthy wrote that “He told me, not long ago, that in designing the ganzfeld procedure, a primary reason for his choosing a telepathy protocol was that it might lead to more ready acceptance, since people seemed less threatened by the idea of ‘mental radio’ than by other ways of conceptualizing psi” (McCarthy, 1993, p.9). Similarly, in discussing so-called sender/no-sender ganzfeld studies, Roe, Sherwood, and Holt (2004) concluded that the receiver’s expectancy as to whether or not a sender was involved in their session might be more important than whether or not a sender was actually involved. Most no-sender studies have adopted a clairvoyance design, however a few studies have tested for precognition in the ganzfeld.

As D. Scott Rogo has said: “Based on the hypothesis that psi represents a unified process there seems no a priori reason that the ganzfeld could not be adapted for the elicitation of precognitive-mediated imagery” (1977, p. 60). Indeed, Rogo is one of the handful of researchers who have used a precognition ganzfeld design, so far as we are aware. In these studies, the target is generated after the participant’s mentation has been reported, and in some cases after the judging has been completed. Significant positive scoring was found in all but one of these studies (see Table 1), though the methods and outcome measures used varied considerably within even this small sample of studies. (We therefore did not attempt to statistically combine these studies in a meta-analysis.) Compared to telepathy and clairvoyance designs, precognition protocols have the advantage of minimizing possible leakage of target-related information that could artifactually inflate hit rates. We suggest that the precognition ganzfeld might be a useful method to adopt, perhaps particularly for studies conducted by trainee experimenters, for those who do not have access to a separate sender room, or who do not have the resources to minimize the security risks that accompany telepathy or clairvoyance designs (e.g., Dalton et al., 1994). This latter point is even more acute nowadays given the ubiquity of mobile communication devices. In order to build on this small database, the present study employed a precognition design.

Table 1

Ganzfeld studies employing a precognition design.

Author	Results summary
Dunne et al., 1977	Mean rank sum 13.17 (6 trials, $p < .04$)
Rogo, 1977	Total correct scores 87/200 (MCE = 100; 20 trials, MCE = 5 per trial, $p = .07$)
Sargent & Harley, 1982	42% hit rate (24 trials, $p < .05$)

Wezelman et al., 1997 "eigensender"(pre-cognition/telepathy blend)	44% (32 trials, $p = .012$)
Roe et al., 2020, experiment 1	35% hit-rate (40 trials, $p = .038$)
Roe et al., 2020, experiment 2	40% hit-rate (40 trials, $p = .007$)
Roe et al., 2020, experiment 3	43% hit-rate (30 trials, $p = .001$)

Evaluating Alterations of Consciousness in the Ganzfeld

In his discussion of the role of altered states of consciousness (ASCs) in extrasensory experiences, Roe (2009, p.40) notes that there is only "meager" physiological evidence to support the assumption that the ganzfeld typically produces a state equivalent to the hypnagogic state that occurs as people drift off to sleep. Indeed there is both observational (Stanford, 1993) and physiological (Wackermann et al., 2001) evidence to suggest that there are wide individual differences in response to ganzfeld stimulation. For the most part, however, ganzfeld researchers neglect to take any measures to test the assumption that the participant is in an ASC during the psi session, or to evaluate whether there is any relation between degree of ASC and psi task performance (Cardeña & Marcusson-Clavertz, 2015).

Physiological measures such as EEG can be invasive and uncomfortable, making it less likely for the participant to be able to relax in the ganzfeld. However there are other self-report measures, such as Pekala's Phenomenology of Consciousness Inventory (PCI, Pekala 1991) and measures of distortions in the perception of time (Stanford, 1984), that may be useful to researchers seeking to establish whether there is any relation between degree of ASC and psi performance in the ganzfeld. Glicksohn's (2001) Retrospective Estimate of Duration task, for instance, may be used as a measure of the degree to which participants were absorbed in the ganzfeld session. Glicksohn suggests that "The more absorbed the subject becomes in his or her subjective experience (due to a predisposition for high absorption and/or via an experimental technique such as introspection or concentrative meditation), the slower time appears to be" (2001, p.9). In the context of the ganzfeld, Glicksohn's reasoning implies that the absorbed participant under-estimates the duration of the impression period.

A few ganzfeld studies have employed questionnaire indices of ASC. Marcusson-Clavertz and Cardeña (2011) investigated how hypnotizability and alterations of consciousness might be associated with scoring in a ganzfeld telepathy task. Alteration of consciousness was measured using the PCI, which has 12 major dimensions of consciousness and 15 sub-dimensions (note that one PCI sub-dimension is Time Sense, however that includes questions about both perceived speeding-up and slowing-down of time, so it cannot be used as an alternative measure of the under-estimation of time). The PCI is a state rather than trait measure, in that participants are directed to complete it with reference to their subjective experiences during a preceding time period. To give a more sensitive measure of psi task performance

than hit or miss, psi z-scores were calculated from each participant's target ratings. The experiment had two sessions. In the first session, participants completed the PCI following a ganzfeld stimulation period that did not involve a psi task. In the second session, which took place on a different day, participants did a ganzfeld telepathy task. Participants were split into high and low hypnotizable groups, and correlations were calculated between these groups and the 12 PCI major dimensions and 15 sub-dimensions (therefore 54 correlations were conducted). Most of the correlations were non-significant, however significant positive correlations were found only for the high hypnotizable group, between psi scoring and the major PCI dimensions of Altered State and Altered Experience, and also between psi scoring and the PCI Altered Experience sub-dimensions of both Altered Perception and Time Sense. Unfortunately it is difficult to know how to interpret these findings, because the correlation was between first session PCI scores following ganzfeld stimulation without a psi task, and second session ganzfeld psi task scores. We do not know whether participants experienced the same altered state the second time they experienced the ganzfeld, particularly given that they knew the second ganzfeld session was a psi task.

Cardena and Marcusson-Clavertz (2020) addressed this limitation by conducting a study where the PCI and the ganzfeld psi task were administered in the same session. They found a significant correlation between PCI scores (greater attentional focus and low arousal during the ganzfeld stimulation period) and psi task performance. This finding is in line with a study (Experiment 1 of Roe et al., 2020) that found performance on a ganzfeld precognition task correlated with greater absorption with subjective experience, lower arousal, and reduced internal dialogue. However a follow-up study (Experiment 2 of Roe et al., 2020) found that only alterations in time sense significantly correlated with ganzfeld performance, and Roe et al.'s experiment 3 found no association between PCI dimensions and ganzfeld performance (Roe & Hickinbotham, 2015). Interestingly, Cardena and Marcusson-Clavertz (2020) administered the PCI before and after the ganzfeld session, enabling them to explore whether there was any correlation between *shift* in Altered State and psi task performance, and indeed a significant positive correlation was found. From the above literature, it seems that currently there is not a clear relation between PCI scoring and ganzfeld task performance.

Objective

Our study aims to add to this small literature by assessing the relation between participants' state of consciousness in the ganzfeld (measured by PCI and Glicksohn's time estimation task) and psi performance (indexed by session z-scores). Selected participants were recruited, following the recommendations of Storm et al. (2010) and Baptista et al. (2015) to increase anticipated effect sizes. This study was designed, pre-registered, and supervised by Watt and sessions were conducted by Dawson, Pooley, and Rice. Watt conducted analyses independently (confirming the analyses by Dawson, Pooley, and Rice). A precognitive protocol was employed for simplicity, for security against leakage of target information, and to add to the small but positive database of precognitive ganzfeld studies. Tullo (a member of the University's IT support staff) wrote the program to control presentation and selection of targets and to record and upload session data, conducted randomness tests, and independently checked the number of direct hits at the end of data collection. The study was pre-registered on the KPU Registry (Watt, 2017b) and, as it meets the inclusion criteria, is the first study to contribute to the prospective meta-analysis of ganzfeld ESP studies (Watt, 2017a).

Method

Materials

Participant Information Questionnaire (PIQ). The PIQ, developed for research at the Koestler Parapsychology Unit, includes demographic questions as well as questions regarding paranormal beliefs and experiences, practice of mental disciplines, and self-reported creativity. A copy is available from the corresponding author on request.

Australian Sheep-Goat Scale (ASGS; Thalbourne, 1995). This 18-item scale includes statements about belief in and experience of putatively psychic phenomena including survival, precognitive dreams, extrasensory perception, and psychokinesis. Participants indicate their attitude to each statement, responding either 0=false; 1=uncertain; 2=true. Therefore scores can range from 0 to a maximum of 36.

Time estimation task. At the end of the exposure period, participants were asked to estimate the session duration from the onset of the relaxation exercise, as follows: "In your estimation, how long did this experiment take in minutes?" This measure was based on Glicksohn's (2001) Retrospective Estimation of Duration task. The participant's monitor displayed a sliding bar that ranged from 0-90 minutes. Below this was the direction, "Move the mouse and click to give your answer." Once participants had clicked to submit their estimation, their responses were recorded on the server. Care was taken to ensure participants did not refer to any timepieces, and experimenters avoided precisely informing participants of the session duration beforehand – so participants knew their visit to the department would take about 90 minutes in total, but were not told how long the exposure period would be.

Phenomenology of Consciousness Inventory (PCI). The Phenomenology of Consciousness Inventory is a valid and reliable self-report questionnaire (Pekala, 1991). The participant rates each of the 53 items on a seven-point scale, with reference to a preceding period (in the present case, the period of ganzfeld stimulation). Each item provides two opposite statements that anchor the responses, for example "I was forever distracted and unable to concentrate on anything" and "I was able to concentrate quite well and was not distracted." The PCI assesses 12 major dimensions of consciousness and 14 sub-dimensions. The dimensions (and sub-dimensions) are: Positive Affect (PA: joy, sexual excitement, and love), Negative Affect (NA: anger, sadness, and fear), Altered Experience (AE: body image, time sense, perception, and meaning), Visual Imagery (VI: amount, vividness), Attention (ATT: direction, absorption), Self-Awareness (SA), Altered State (AS), Internal Dialogue (ID), Rationality (RA), Volitional Control (VC), Memory (ME), and Arousal (AR).

Relaxation and white noise track. When initiated, the computer program plays the participant an audio recording consisting of approximately 9 minutes of a progressive relaxation exercise, followed by guidance on reporting mentation lasting approximately one minute, followed by 25 minutes of white noise.

Target Pool. There are 50 target pools, each consisting of four dynamic visual targets (60-90-second color film clips with audio), which had been obtained from the Internet (e.g. YouTube clips, home movies, arts media projects) grouped with the aim that they be orthogonal to one another (seeking to

avoid overlapping content). During the experiment, the target pools and targets were sampled with replacement. The target pool was created by visiting student research interns.

Random Number Generator. The TrueRNG3 (USB hardware RNG produced by ubld.it) was used whenever a source of randomness was needed in this study (for target pool selection, order of presentation of target pool on screen for judging, and for target selection.) The RNG was tested by Tullo before formal data collection began, simulating 1,500,000 trials. The relative frequency of each of 4 clips being selected as target did not deviate from MCE (1/4) by more than 0.03%. The relative frequency of each of the 50 pools being selected did not deviate from MCE (1/50) by more than 0.03%. The relative frequency of each of the 200 clips being selected as target did not deviate from MCE (1/200) by more than 0.02%.

Participant Recruitment and Selection Criteria

Participants were primarily recruited from the KPU volunteer panel (mostly consisting of individuals who have visited the Koestler Parapsychology Unit website and submitted their contact details via the “participate” button), and also through social media and personal contacts of the experimenters. They were selected on the basis of their responses to the KPU Participant Information Questionnaire. Participants under 18 and those who reported a mental health disorder currently or within the past 5 years were excluded from participation. Volunteers were selected for participation if they reported at least one of: practice of a mental discipline; previous psi belief or experience; and creative/artistic ability (“How would you rate yourself for level of creative/artistic ability?” 5-point scale anchored Low and High), scoring at least 3 on this question.

Experimenter Characteristics and Lab “Ambience”

The three experimenters who had contact with participants were female final year undergraduate psychology students in their 20s, and rated their belief that the psi hypothesis in this study would be supported as 3, 4, and 5 (where 5 = strongly supportive). Watt, who rated her belief that the psi hypothesis in this study would be supported as 4, had no contact with participants other than initially emailing to thank those who had volunteered themselves for research participation via the KPU website. Watt monitored the progress of the experiment to ensure that it was on schedule, and periodically copied the recordings of the session mentations for later transcription, all the while remaining unaware of the session outcome. Considerable efforts were made to create a welcoming and friendly atmosphere for participants. The reception room was decorated with art prints of Edinburgh, had comfy seats around a small coffee table, and refreshments were provided. To help provide a pleasant environment in the ganzfeld chamber, lighting was kept low, the walls were draped with fabric wall hangings, and a blanket was provided to help participants feel comfortable in the reclining chair. The experimenters sought to be welcoming and friendly with participants.

Procedure

The experiment was approved by the University of Edinburgh School of Philosophy, Psychology and Language Sciences ethics committee. It was conducted on the premises of the Psychology department between December 2017 and March 2018.

The experimenter prepared the ganzfeld laboratory, initiating the experiment program, inputting the date and time, and indicating whether the session was formal or informal (date and time was automatically collected by the program as well). Initial practice sessions were labeled as informal and were excluded from analysis; all sessions included in this study were formal, and no formal sessions were excluded. The initial session information was uploaded to a remote server by the program before the rest of the session progressed.

On arrival, participants were taken to the reception room and briefed about the procedure, including tips on free-response judging (Delanoy et al., 2004), and any questions were answered. They then completed the ASGS (in paper-and-pencil form) and were taken to the ganzfeld laboratory (a windowless metal chamber that has no adjoining rooms) located about 100 meters away from the reception room in a garden outside the main psychology building. The participant reclined in a comfortable chair in the chamber. The experimenter monitored the participant from within the same chamber. Adjacent to the reclining chair was a small table with a computer keyboard, monitor, and digital audio recorder. A floor-standing anglepoise lamp was also adjacent to the chair.

The lamp was directed towards the participant who wore the translucent red eye-mask, and the distance was adjusted to a comfortable level, so that with eyes open the participant perceived a uniform red field. The experimenter briefly reiterated the procedure, making sure that the participant understood it was a precognition study and that the goal was for their mentation to relate to the randomly chosen target that they would see at the very end of the session. The experimenter answered any remaining questions. The participant donned the headphones and the program then played a few seconds of white noise so the participant could adjust the volume to a comfortable level. The experimenter activated the recorder and recorded the experimenter's name, the participant's ID number, and the date and time. The experimenter remained in the room with the participant as the session proceeded.

The audio recording first delivered the relaxation exercise and then played the white noise during which time participants reported their thoughts, feelings, and imagery (the mentation period). Just prior to the mentation period, the audio recording directed the participant to make a gentle wish that their thoughts and impressions during the session would relate to the target. The participant's mentation was audio recorded and the experimenter also took notes of the mentation as the participant spoke.

At the conclusion of the mentation period, participants removed their headphones and eye-mask. Participants' monitors prompted them to estimate the duration of the session. The experimenter then reviewed the mentation with the participant and invited them to make any further comment or elaboration on their impressions. When the participant was ready to judge the target possibilities, the computer program randomly selected a target pool and then randomly ordered the four clips for presentation to the participant for judging. The participant viewed each clip and rated each clip from 1 (= no correspondence) to 100 (= perfect correspondence) to reflect the perceived similarity between the mentation and the clip. No tied ratings were permitted. The experimenter could remind the participant of their mentation report during the judging (the experimenter and participant were still blind to the target identity at this point.) The participant could review any of the clips and make changes to their

ratings until the point that they finally decided to submit their ratings. When the ratings were submitted, the program uploaded the participant's ratings in duplicate (locally and to a distant server). The PCI was then administered as a paper-and-pencil measure.

Finally, as this was a precognition design, when the participant was ready to discover the identity of the target the target clip was randomly selected by the program. The target identity was uploaded to the remote server before it was revealed to the participant and the experimenter.

Precautions against Fraud and Error

This study took several precautions to attempt to minimize experimenter and participant fraud and error.

1. There were three experimenters (one per session, 20 trials per experimenter). Mentations were recorded for later transcription.
2. During the session, the data were automatically dated and time-stamped and kept in duplicate, both locally on the lab PC, and uploaded to a remote University of Edinburgh server. The time stamp was added by the server and so could not be faked by the experimenter. The IP address of the incoming message was also recorded, so messages sent from anywhere other than the experiment PC would be detected. The experimenters and lead researcher did not have access to the remote server because only the programmer had the password to the server. The programmer was a member of the IT support staff for the School of Philosophy, Psychology and Language Sciences, and had no affiliation to the KPU or vested interest in a particular study outcome.
3. There were three data uploads. The first occurred at the start of the session (recording experimenter ID, participant ID and demographics, and whether the session was classified as formal or informal). The second occurred when the participant's target ratings had been completed and submitted, before the target identity was randomly selected, and included the time estimation task score. The third occurred after the target was selected and before the experimenter or participant had seen the target identity. All formal trials were reported.
4. To prevent the risk of leakage of target information before the target judging was completed, a precognition design was used. Therefore the judging was completed, recorded, and uploaded before the computer randomly selected the target.
5. To prevent bias or patterning in the target selection, a commercially available RNG (TrueRNG3) was used to randomly select the target pool, the order of presentation of the target clips during judging, and the target. The study RNG was tested to make sure there was no bias in the relative frequency of target pool selection (1/50), of target clip selection (1, 2, 3, or 4), or of target selection (1/200).
6. After conclusion of the data collection, the programmer independently verified the number of direct hits by checking the duplicate data held on the remote server, unaware of the number of hits the experimenters had recorded on the computer running the experiment. No discrepancy was found.

Hypotheses

The study was pre-registered on the KPU Study Registry (Watt, 2017b). The planned number of participants was 60, with one trial per participant. Both hypotheses were exploratory for three reasons: 1. It is the first study run using a new automated ganzfeld testing program at the KPU; 2. There are few previous ganzfeld studies using a precognition design. 3. Limited resources mean that the study has a sub-optimal power for a confirmatory study.

H1: Participants will correctly identify the randomly selected target clip at greater than chance expectation (tested using exact binomial probability, where $p_{\text{hit}} = .25$, $\alpha p \leq 0.05$, one-tailed).

H2a and 2b: Those participants showing alterations of consciousness during the ganzfeld session (as indexed by the PCI and the time estimation task) will have higher scores on the precognition task (tested by correlating PCI scores and time estimation scores against session z-score calculated from target and decoy ratings, $\alpha p \leq 0.05$, one-tailed). It was predicted that those participants who under-estimated the duration of the session would have better psi performance than those who were accurate or who thought that the session lasted longer than it actually did.

Results

Participant Demographics

Sixty volunteers (28 male, 32 female, $M_{\text{age}} = 34.2$, $SD = 18.13$, Range 18-80 years) took part in the study, and 34 were students. The majority of participants had either self-reported as creative/artistic (83%), practiced a mental discipline (78%), and/or had previous psi experience (85%). Australian Sheep Goat Scale $M = 16.17$, $SD = 8.77$; 47% of participants scored ≥ 18 on the ASGS.

Missing Ratings

About three-quarters of the way through the experiment, AP inspected the computer records of the session results, and discovered that some target ratings were missing on four trials and reported this fact to CW. At this point CW did not know whether these trials had been hits or misses. While still unaware of the session outcomes, CW decided not to conduct any extra sessions to replace the affected trials, but to include the computer's hit or miss score for these four trials in the overall test of the precognition hypothesis, but to discard these four trials from the testing of the ASC hypotheses (because session z-scores could not be calculated with missing ratings.) Table 2 shows the details of the trials on which the computer record of clip ratings was incomplete.

Table 2

Trials where target ratings were not fully recorded.

Trial number	Clip1 rating	Clip2 rating	Clip 3 rating	Clip 4 rating	Highest rated clip	Target clip
8	1	-	-	-	3	3 (=hit)
20	-	-	-	-	1	4 (=miss)
30	70	80	-	-	2	2 (=hit)
40	-	1	-	-	4	4 (=hit)

Hypothesis 1: Precognition task performance. Participants had 22 direct hits out of 60 trials (37% hit-rate). The count of 22 hits recorded by the computer controlling the session was independently verified by checking the duplicate session data held on the remote server. This was statistically significant on the planned test (exact binomial $Z = 1.94$, $p = 0.03$, 1-t, $ES (Z/\sqrt{N}) = 0.25$), thus supporting Hypothesis 1 that participants could correctly identify the precognitive target from among the decoy targets. Table 3 shows the ranks allocated to the target (due to the software error, the target ranking was not available for one trial where a miss occurred therefore $N=59$ for this table).

Table 3

Target rankings

Rank of target video	First	Second	Third	Fourth
Frequency	22	14	9	14
Rate (%)	37	23	15	23

Hypothesis 2a, 2b: Relation between measures of ASC and psi task performance.

As planned for the purposes of correlational tests, session z-scores were employed as a potentially more sensitive index of psi task performance than direct hits. Session z-scores were calculated from the participants' target and decoy ratings, using the following formula:

$$Z = \frac{X_i - \bar{X}}{\sqrt{S_x/N}}$$

where X_i is the rating assigned to the target, \bar{X} is the mean of all ratings in the trial, S_x is the standard deviation of the ratings, and N is the number of ratings in the trial (= 4). Session z-scores ranged from 17.14 to -15.61 ($M = 1.35$; $SD = 8.21$).

Phenomenology of Consciousness Inventory. To test Hypothesis 2a, session z-scores were correlated against the 12 major PCI dimensions. The correlations were either rather small or near-zero (see

Table 4), and no significant relation was found between psi task performance and PCI scores, therefore no support was found for Hypothesis 2a ($df = 54$ because in four sessions ratings were unavailable and z-score could not be calculated. No correction for multiple analyses has been applied.)

Table 4

Spearman correlations between PCI dimensions and session z-scores; $p(2-t)$

	AE	PA	NA	ATT	IM	SA	AS	AR	RA	VC	ME	ID
rho	.02	-.09	-.06	-.16	.14	.17	-.12	-.14	.12	.14	.09	.14
p	.90	.50	.670	.25	.30	.21	.38	.30	.38	.32	.52	.31

Time estimation. The objective duration of the combined relaxation exercise and impression period was about 35 minutes. Participants' estimates of the duration of the relaxation and impression period ranged from 8 to 90 minutes ($M = 26.30$ minutes, $SD = 13.49$).

To test Hypothesis 2b, session z-scores were correlated against participants' estimations of time duration for the session. It was predicted that participants who under-estimated the time of the session (and whose state of consciousness was apparently more altered from the normal waking state) would have better psi performance. Due to an outlier in the time estimation data, it was decided to use a non-parametric Spearman's correlation. The predicted relation was not found ($rho = 0.075$, $df = 54$, $p = 0.582$), so Hypothesis 2b was not supported.

Discussion

This study was the first to contribute to a registration-based prospective meta-analysis of ganzfeld ESP studies (Watt, 2017b). As recommended by recent reviewers of the ganzfeld ESP database (Baptista et al., 2015; Storm et al., 2010), we sought to maximize the anticipated effect size by selecting participants for any combination of self-reported creativity, prior psi experience or belief, or practice of a mental discipline. Our study employed an automated precognition design for simplicity and security, and to add to the small but positive database of precognitive ganzfeld studies. Three experimenters each conducted 20 trials, and 22 direct hits were obtained (37% hit-rate), significantly supporting the study hypothesis that participants would be able to correctly identify the randomly chosen future target video clip from amongst the decoy targets.

Addressing researchers' recommendations (Cardeña & Marcusson-Clavertz, 2015; Roe, 2009) to test the assumption that the ganzfeld method elicits a psi-conducive altered state of consciousness, we correlated two measures of ASC with psi task performance, predicting higher target similarity ratings would be associated with greater evidence of alterations of consciousness during the session. However, our results did not replicate the findings of Cardeña and Marcusson-Clavertz (2020), who found that ganzfeld task performance correlated positively with the PCI scale attention and negatively with the scale for arousal.

Like Roe et al. (2020), our study found no consistent relation between PCI and ganzfeld psi task performance. Considering why there seems to be some inconsistency in findings from studies that have sought to correlate PCI scores with ganzfeld task performance, it is possible that the studies reporting correlations between PCI and session z-scores (Cardeña & Marcusson-Clavertz, 2020; Roe et al., 2020 Experiments 1 and 2) obtained some spurious correlations due to Type I error. This is possible because there are 12 PCI major dimensions and 14 sub-dimensions, so without correction for multiple analyses spurious correlations are bound to occur just by chance. Furthermore, methodological variations such as administering the PCI in a separate session to the ganzfeld psi session (Marcusson-Clavertz & Cardeña, 2011) or having just 20 minutes of ganzfeld stimulation (Cardeña & Marcusson-Clavertz, 2020) could also introduce some extraneous factors that could make meaningful relations harder to detect. At this stage we can only conclude that there seems to be little consistency in how PCI scores relate to ganzfeld performance, and we would recommend correction for multiple analysis to reduce the risk of reporting spuriously significant correlations in future.

Furthermore, using Glicksohn's (2001) time estimation task, we did not find support for the hypothesis that participants who underestimated the duration of the session would perform better on the ganzfeld precognition task. Our results also fail to conceptually replicate those found in a ganzfeld study by Bierman (1988), whose participants were asked to do a time reproduction test that is conceptually similar to Glicksohn's task, after the ganzfeld stimulation ended. The 10 participants who were categorized by Bierman as time contractors obtained a 77% hit-rate (10 trials), compared to a 17% hit-rate for the 6 who were not contractors. Bierman identified "time contractors" as anyone who estimated a time that fell below the median. The median time estimation in the present study = 25 minutes. On this criterion, 28 of our participants deemed to be time contractors obtained 9 hits (32% hit-rate), and 32 participants deemed not to be time contractors obtained 13 hits (41% hit-rate), so if anything our results trended in the reverse direction to that expected following Bierman (1988). Nevertheless, we agree that there is a need for parapsychologists to continue to assess the assumptions underlying our research methods, and urge that future ganzfeld studies attempt to assess participants' state of consciousness during the experimental session.

Conclusion

Although many researchers have understandably shifted their interests to unconscious measures of psi (e.g., Bem, 2011), we feel that ganzfeld research deserves continued effort. First, despite using an environment (ping pong balls, white noise, red light) that some people might think is different from real life settings, the use of relaxation and mild sensory isolation to elicit possibly psi-conducive states of consciousness maps onto the characteristics of many spontaneously reported paranormal experiences (e.g., Rhine, 1961; Roe, 2009). When designing our studies, we think it is important not to lose sight of how extrasensory experiences appear to manifest in the real world. Second, there is the opportunity to build upon the considerable work that has already been done with the ganzfeld method. This includes: recruiting selected participants, as indicated by trends in prior studies; using techniques such as study registration and prospective meta-analysis (PMA) to increase confidence in study outcomes; and adopting more process-oriented research efforts such as assessments of altered state of consciousness in the

ganzfeld. Finally, our study adds to the small database of ganzfeld studies with a *precognition* design that have nearly all obtained positive results. Researchers may be deterred from using a telepathy design partly due to the difficulty nowadays of ensuring no leakage of information about the target, so it is encouraging to find that the more simple and secure precognition method has so far proved fruitful.

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Test de la Précognition et des États Modifiés de Conscience avec des Participants Sélectionnés dans le Ganzfeld

Résumé. Cette étude est la première à contribuer à une série d'études de la perception extra-sensorielle dans le Ganzfeld intégrées dans une méta-analyse prospective pré-enregistrée. Nous avons cherché à maximiser la taille d'effet psi anticipée en sélectionnant des participants à partir de la créativité au-

to-rapportée, les expériences ou croyances psi préalables, et la pratique d'une discipline mentale. Nous avons également employé un protocole automatisé de précognition à des fins de simplification et de sécurité, et également pour l'inclure dans la base de données des rares études précognitives en Ganzfeld. Les cibles et les leurres étaient de courts clips vidéo sélectionnés aléatoirement avec remplacement dans une réserve de 200. En plus de prédire le score global significatif sur la tâche précognitive au Ganzfeld, l'étude testait l'hypothèse selon laquelle la méthode Ganzfeld favorise un état modifié de conscience favorisant le psi, en corrélant deux mesures d'états modifiés de conscience avec les performances à la tâche précognitive. Nous avons prédit des meilleures évaluations de similitudes des cibles corrélées avec des manifestations plus claires d'états modifiés de conscience durant la session. Les trois expérimentateurs ont chacun conduit 20 essais. Vingt-deux réussites directes furent obtenues (taux de succès de 37 %), ce qui vient soutenir le test planifié de performance à la tâche précognitive (binomiale exacte $p = .03$, 1-t). Aucune relation ne fut trouvée entre les états modifiés de conscience et les performances à la tâche psi, contrairement à ce qui était prédit. Nous concluons en discutant l'intérêt des futures recherches sur la perception extra-sensorielle en Ganzfeld.

Zur Überprüfung von Präkognition und veränderten Bewusstseinszuständen mit ausgewählten Teilnehmern im Ganzfeld

Zusammenfassung. Diese Studie ist die erste, die zu einer prospektiven Metaanalyse von zuvor registrierten Ganzfeld-Studien zur Außersinnlichen Wahrnehmung (ASW) beiträgt. Wir versuchten, einen erwarteten Psi-Effekt zu maximieren, indem wir Teilnehmer aufgrund ihrer selbstberichteten Kreativität, früherer Psi-Erfahrungen oder -Überzeugungen oder der Ausübung einer mentalen Disziplin auswählten. Aus Gründen der Einfachheit und Sicherheit verwendeten wir auch ein automatisiertes Präkognitionsdesign, um zusätzlich zur Erweiterung der geringen Datenbasis präkognitiver Ganzfeldstudien beizutragen. Ziel- und Kontrollbilder waren kurze Videoclips, die zufällig aus einem Pool von 200 Bildern mit Zurücklegen ausgewählt worden waren. Neben der Vorhersage eines signifikanten Gesamteffektes der Ganzfeld-Präkognitionsaufgabe sollte die Studie auch die Annahme testen, dass die Ganzfeld-Methode einen psi-förderlichen veränderten Bewusstseinszustand hervorruft, indem zwei Maße des veränderten Bewusstseinszustands (Altered State of Consciousness, ASC) mit dem Ergebnis der Präkognitionsaufgabe korreliert wurden. Wir sagten vorher, dass die Ähnlichkeit der Übereinstimmungen mit den Zielbildern mit dem Grad der Ausprägung des ASC während der Sitzung verknüpft war. Drei Experimentatoren führten jeweils 20 Einzelversuche durch. Es wurden zweiundzwanzig direkte Treffer erzielt (37% Trefferquote), was den geplanten Test der Ganzfeld-Präkognitionsaufgabe signifikant unterstützt (exakter Binomialtest $p = .03$, 1-t). Entgegen der Vorhersage wurde kein Zusammenhang zwischen dem ASC und der Psi-Aufgabe gefunden. Abschließend diskutieren wir die Gründe, die für eine Fortsetzung der Ganzfeld-ASW-Forschung sprechen.

Evaluación de Precognición y Alteraciones de Consciencia en Ganzfeld con Participants Seleccionados

Resumen. Este es el primer estudio en contribuir a un meta-análisis prospectivo basado en registro de estudios de Percepción Extrasensorial (PES) en ganzfeld. Intentamos maximizar el tamaño anticipado del efecto psi seleccionando participantes con creatividad autoinformada, experiencia o creencia psi previa, o práctica de una disciplina mental. También empleamos un diseño de precognición automatizado por simplicidad y seguridad, y para agregar a la pequeña base de datos de estudios precognitivos de ganzfeld. Los objetivos y los señuelos fueron segmentos de 200 video seleccionados al azar con reemplazo. Además de predecir una puntuación general significativa en la tarea de precognición en ganzfeld, el estudio evaluó la hipótesis de que el método ganzfeld provoca un estado alterado de consciencia facilitador de psi, correlacionando dos medidas de estados alterados de consciencia (EAC) con el rendimiento en la tarea de precognición. Predijimos que las puntuaciones de similitud de objetivos más altas se asociarían con una mayor evidencia de EAC durante la sesión. Tres experimentadores realizaron cada uno 20 ensayos. Se obtuvieron 22 aciertos directos (37% de aciertos), lo que respalda significativamente la prueba planificada de la tarea de precognición en ganzfeld (probabilidad binomial exacta = 0.03, 1-t). No encontramos relación entre el rendimiento de la tarea EAC y psi, contrariamente a nuestra predicción. Concluimos discutiendo las razones por las que se justifica investigación adicional de PES en ganzfeld.